Compressed Air

A MONTHLY MAGAZINE DEVOTED TO THE USEFUL APPLICATION OF COMPRESSED AIR.

VOL. VI. NEW YORK, JANUARY, 1902. No. 11.

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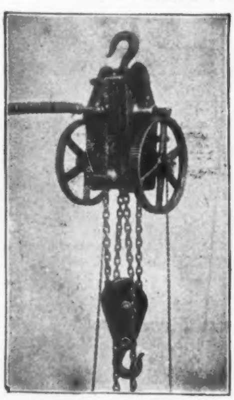

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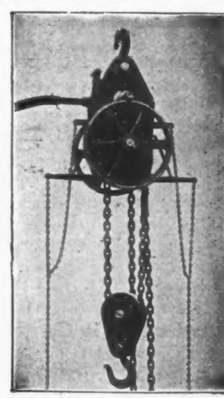

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OR

THE COMPRESSED AIR MAGAZINE.

A MONTHLY PUBLICATION DEVOTED TO THE USEFUL APPLICATION OF COMPRESSED AIR.

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Subscription, including postage, United States, Canada and Mexico, $1.00 a year. All other countries, $1.50 a year. Single copies, 10 cents.

Advertising rates furnished on application.

We invite correspondence from engineers, contractors, inventors and others interested in compressed air.

All communications should be addressed to COMPRESSED AIR, 26 Cortlandt St., New York.

London Office, 114a Queen Victoria Street.

Those who fail to receive papers promptly will please notify us at once.

Entered as Second-Class Matter at the New York N. Y., Post Office.

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As the majority of our readers are engineers and many are active members of the American Society of Mechanical Engineers, we feel that a reference to the recent annual meeting of that society, held in New York city, will not be out of place.

A thorough discussion of at least one subject was anticipated, and no one was disappointed in this respect, as the debate continued for three full hours and came to an end only because the time limit was reached.

The trouble, for such it was, arose from an attempt on the part of the officers of the society to force through an increase in the annual fees raising members dues from $15 to $25, and juniors, who, by the way, could have no voice in the matter, from $10 to $15. The ostensible reason for this increase was the necessity for meeting increased expenses and a desire on the part of the council to undertake a series of tests and researches to determine constants and engineering data. The proposed increase figured out about $20,000 per year, a considerable sum, in fact, nearly half the entire society's annual income up to that time.

A strong opposition sprang up when the change was proposed previous to the meeting and several of the prominent engineering journals took a determined stand against any such action, and secured proxies with which to prevent the council's plan being carried out.

At the meeting it developed that there was an accumulated debt of over $13,000 incurred, entirely unknown to the members, and even the council, until the previous meeting on Oct. 31. What gives the matter a worse color is the fact that this debt had been accumulating for the past four years entirely unknown to the membership, who have each year been lead to believe that the finances of the society were in a flourishing condition. Only last year the annual report announced that the second mortgage on the society's house, 12 West Thirty-third street, New York, had been paid and that steps would next be taken to gradually reduce the first mortgage.

It may readily be imagined that this information, announced for the first time at the meeting, brought down a merited and severe censure upon the council and officers of the society; needless to say the motion was lost, being buried by a vote of 647 against 191.

The councıl announced that it had found means to reduce the annual expense by from $4,000 to $5,000 and had appointed a committee to investigate and determine upon some plan to effect other savings and

avoid increasing the dues, and at the same time to wipe out the debt.

It is high time such action were taken, and we hope that the publicity given the matter will have a permanently beneficial effect. The value of the society is beyond dispute, but access into it should not be made difficult by expense alone. The American Mechanical Engineering Society, to be worthy of the name, should increase its importance and prestige by increasing its entrance and advancement requirements and not by jumping its dues 66 2-3 per cent., especially when they already compare favorably with other societies of a like character, differing only in the branch of engineering, to which they are devoted.

This discussion again brings up the subject of a Union Engineering Society house, a consolidated engineering society, so far as house, library, printing and running expenses are concerned, with all their individual characteristics retained. This idea has long been popular among engineers. Before the American Society of Civil Engineers moved to its present quarters of Fifty-seventh street, New York, it was hoped that other engineering societies would join with them in a common building. Even now such a plan might be carried out should a Pierpont Morgan arise among engineers.

We hope that this question will be agitated until such an economical and happy arrangement can be brought about It is purely a business proposition and it is surprising that the engineering profession, always on the lookout, and, in fact, the first to advocate any plan looking towards economy, should be so far behind their brothers in the business end of our great railway and manufacturing concerns.

Caisson Foundations, the New York Stock Exchange.*

The plans for the new building of the New York Stock Exchange, located on Broad street, New York City, require the foundations to be carried to the rock, which is at a depth of about 60 ft. below the curb-line. The material to be penetrated is water-bearing, and is largely made up of a fine micaceous quicksand, with some clay strata. In the case of the Stock Exchange, and, for the first time, so far as we know, a continuous concrete masonry wall is being built by means of caissons sunk by the employment of compressed air.

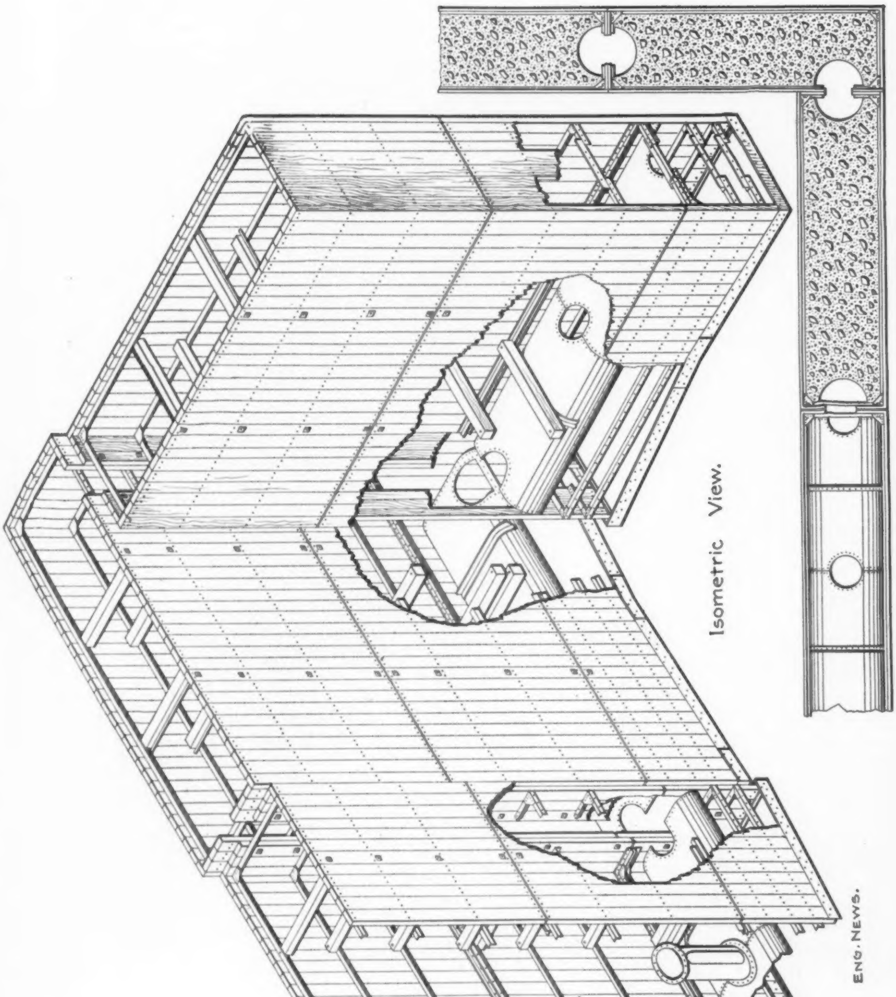
This novel departure in caisson foundation work is the invention of Mr. John F. O'Rourke, M. Am. Soc. C. E., Park Row building, New York city.

The caissons used are built of wood instead of iron. Each is rectangular in shape, 30 ft. long and 8 ft. wide, outside measurement. The lowest, or air-chamber section, is 8 ft. high, and the chambers above it are each 15 ft. high. It might be mentioned that the latter height was due to the proposed transport of these caissons in sections across the Brooklyn bridge; but as it was later decided to lighter them across the East River, they might have been made much higher. The caisson walls are built up of vertical timbers, 4 ins. thick, strongly tied and braced together internally by angle irons; and thoroughly calked at all the seams.

The large caissons weigh about 15 tons each, and they are handled and set in place for sinking by powerful boom-derricks. To sling these caissons, an interior frame is employed made of 4 × 4 × ½-in. angles, and 8 ft. long by 6 ft. wide. In the four inner corners of this frame are heavy gusset-plates, slightly bent in the line of the hoisting chains, and provided with 2-in. holes for connecting two sets of 1½-in. hoisting chains, each set having its own ring. From each corner of this frame hang about 4 ft. of heavy chain, terminating in an eye-iron with a threaded end.

As these caissons are to be sunk by means of compressed air, an air chamber is provided in the bottom section by covering this section with an iron roof, which is arched in the two outside thirds of the

*Abstract of a paper published in the Engineering News, for Sept. 26, 1901.



ISOMETRICAL VIEW ILLUSTRATING THE PROCESS OF SINKING CONTINUOUS CAISSON FOUNDATIONS.

width of the caisson, and strengthened by angle-iron ribs. The middle third is left flat to permit better connection with the working shaft, and also for the end connections, to be described. The shaft for communicating with the air chamber and for extracting the material, is located at the middle of the length of the caisson. The caisson is well slushed on the outside to assist in its descent, and is sunk to the bed rock in the usual manner.

The concrete within the first caisson has to be intimately united with the concrete in the adjoining caissons. This is accomplished in the following manner: As the first caisson is being sunk and filled with concrete above the roof of the air chambers, iron forms are set at each end of the caisson, in such a manner as to leave open wells in the concrete adjoining the caisson ends. These half-wells are of semi-elliptical cross-section and about 4×5 ft. in size, the long axis being parallel with the wall. The iron forms used for making these wells are removable, wooden wedges being employed on the flat sides. Immediately under each of these wells, and in the roof of the air chamber, a semi-circular plate is bolted, 3 ft. in diameter. When the air chamber of the first caisson sunk is filled with concrete, forms are set to make a continuation of the two wells left in the concrete above the air chamber.

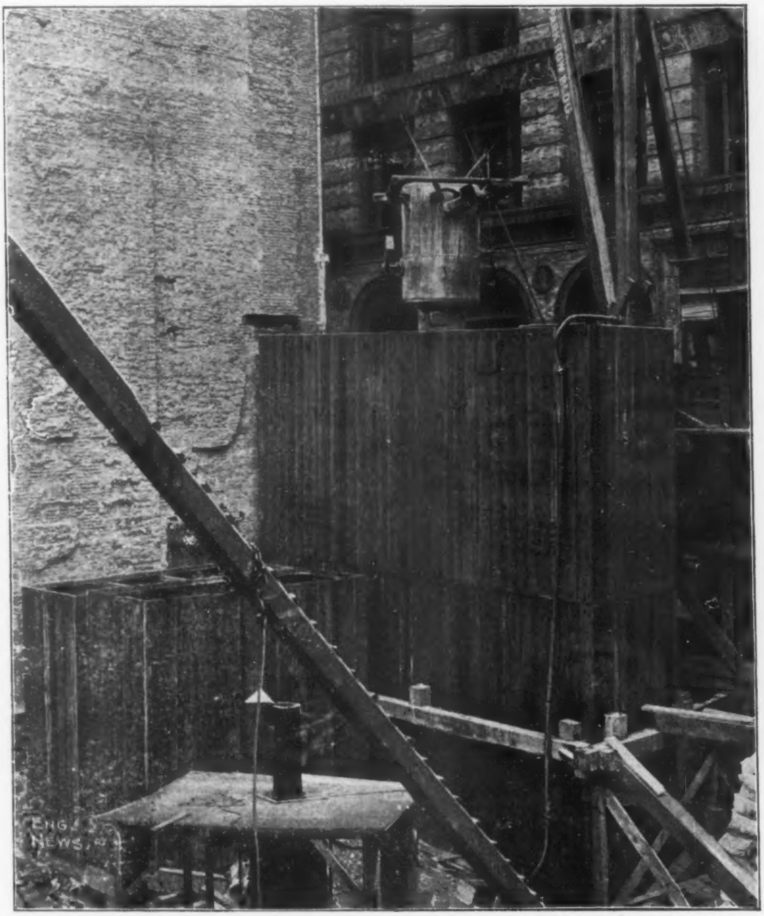
After this is accomplished the second caisson is sunk as close as possible to the first one, and open wells are left in the upper concrete filling, as was done in the first caisson. When the second caisson reaches the rock, and the bottom edge has been sealed, preparations are made for connecting the two adjoining air chambers. In the end timber walls of each caisson—on the line with the air chambers—two removable doors are provided in the original construction. These doors are rested against beveled seats in the caisson wall, and both of them open towards the second caisson. The bolts securing the door in the second caisson are first removed and the door is pulled into the air chamber. As this is done men stand ready with balls of clay, which are quickly thrust into the space between the two caissons, and are held there by the air pressure, sealing the joint against the entrance of water. The door in the first caisson is thus exposed, and is then removed—in the same manner as the first door. Communication is thus established between the well-space left in the concrete of the first air chamber, and the air chamber of the second caisson. The adjacent walls of the two caissons are now forced together by heavy bolts, and an absolute water-tight joint is made between them by wedging—if necessary.

The filling of the well and of the second air chamber with concrete can now be commenced; the union between the old and new concrete being carefully made. When the second air chamber is filled, the 3-ft. semi-circular plates in the air-chamber roof can be removed and connection is thus made with the open well above extending to the top of the caisson. The wooden ends of the caissons and the angle-iron braces within have been especially designed to facilitate the connection above described. Next, working in these wells two lines of bolts are placed, drawing the wooden end walls of the adjacent caissons close together. A water-tight joint is thus secured, and the timbers of both caissons inside these bolts can now be removed; and when the well is filled, the concrete masonry of one caisson is thoroughly united with that of the other. Of course, at the angles of the foundations, the connecting well in the concrete of one of the caissons would be located at the side instead of the end.

Simultaneously with the sinking of the continuous caissons about the site of the building, circular caissons, also of wood, and 6 ft. 8 ins. in diameter, are being sunk to the rock in the interior of the area. Within these caissons, and at their bottom, will be placed the column footings. When the sinking of the exterior line of caissons is completed the earth in the interior will be excavated. While this work is going on, the caissons will be strongly braced to resist any inward movement from the outside pressure. With the rock bared and concreted, the columns are set and the bottom system of beams is put in place. The set of beams above the lowest is made to act as a system of struts, to permanently carry the external pressure on the caissons. Horizontal bearing beams are set against the walls of the caissons; and then by means of hydraulic jacks the struts abutting against these beams are put under an initial compression greater than that exerted upon the caissons from outside, considering them

as retaining walls, and as sustaining hydrostatic pressure.

As absolute impermeability is one of the requisites of this continuous masonry caisson construction, Mr. O'Rourke has devised a means of filling up the vacancies due to the inevitable slight shrinkage of the concrete in setting. In filling the cais-

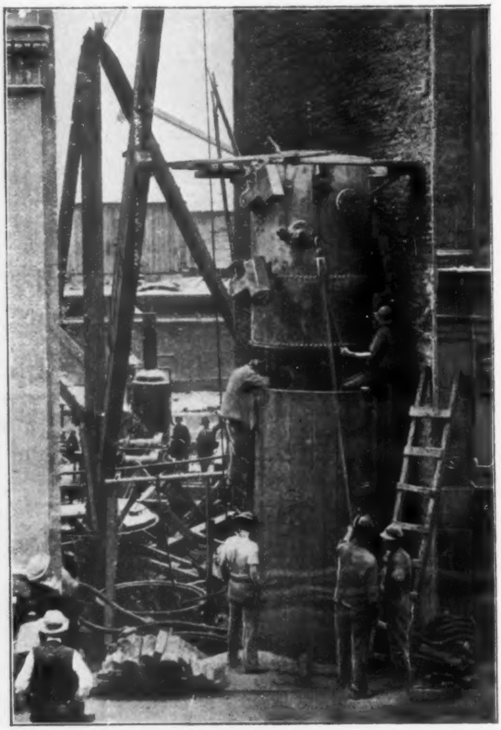


CAISSON THREE SECTIONS HIGH IN PROCESS OF SINKING.

(The two adjoining caissons will be sunk close to the wall at the left.)

sons and connecting the concrete masonry, the air shaft in the center of each caisson is left unfilled until a sufficient time has elapsed for the setting of the concrete, and a space is left in the surface of the air-chamber filling at the bottom of this shaft. The air shaft is then fitted with a door at the top and connection is made for air pressure. Thin grout is next deposited at the bottom of this air shaft, the upper door is closed, and the air pressure turned on. The effect of this operation is to force the grout into all shrinkage spaces and to thoroughly seal the entire mass of masonry against percolation.

The air-chamber gang consists of eight men and a foreman. The material is shoveled into a bottom-dump bucket, 30 ins. in diameter and 36 ins. high; and by special appliances, patented by Mr. O'Rourke, the material is hoisted out through the air lock and deposited upon the dump about as fast as the men can shovel it into the buckets. In removing this quicksand the men average about 10 cu. yds. per hour; the maximum rate of sinking a caisson being 4½ ft. in 4 hours.



CYLINDERS BEING SUNK FOR FOUNDATIONS IN THE NARROW WALL STREET EXTENSION OF THE NEW STOCK EXCHANGE BUILDING.

(The undulating lines on the lower part of the photograph are made by the hats of passing pedestrians.)

Central Compressed Air Power Plants.

The subject of compressed air is daily receiving more attention, both from the popular standpoint and from its engineering side. One of the reasons for this is that within recent years a number of very large undertakings, in which the general public has been deeply interested, have been quickly completed or are now under way and rapidly nearing a finish, as a result of the application of compressed air. In these the use of air was carried to a considerable extent, and they have proved beyond a doubt the flexibility, economy and general desirability of this medium for general power purposes.

Among civil and mechanical engineers, especially those engaged in the construction of large engineering undertakings, compressed air has long occupied an unassailable position, and each year sees its uses enlarged and a knowledge of its possibilities spreading into spheres where formerly compressed air was known as hardly more than a laboratory experimental medium. A very few years ago it was used only to operate rock drills; today it stands on a level with electricity, as far as its wide range of adaptability is concerned, and the wonderful increase in its use bids fair to soon put it on an equal footing with its "twin brother" in many other respects.

In various parts of our own country there are in operation a large number of compressed air installations where air power is used for a wide rangs of purposes, formerly done by hand, or believed to be reserved for electricity, or hydraulic power alone. In fact, so rapidly have the number of these plants multiplied that the term "Central Compressed Air Power Plant" is fast becoming as familiar as the older expression "Electric Lighting Station." This natural growth in the use of compressed air carried it through the early stages where it was employed to operate rock drills and other apparatus in a few special places in which the conditions were so abnormal that even while the production of compressed air was exceedingly expensive, its use was necessary to accomplish the desired results.

This development also carried it through the second stage, where the cost of compressed air was reduced by improvements in compressors and machinery for using air, and has brought it to a point where it was introduced into mines, tunnels, quarries and general contracting work. Success was rapid in these applications and prompted the next step, the use of air to a greater extent, and for more varied purposes, a step which brings us directly to the subject of this article—"Central Compressed Air Power Plants."

Before proceeding to examine some of the principal installations which may be regarded as typical of the Central Compressed Air Power Plant, it will be of interest to review briefly the general or surrounding conditions which have led up to the necessity of such establishments.

For convenience, Compressed Air power plants may be sub-divided into four general classes: 1, mining; 2, general contracting; 3, machine shop; 4, quarrying. Into these they naturally fall, according to the character of work for which intended.

The necessity of rapid means of transportation and inter-connection between cities or manufacturing establishments and cities, and all of these and the seaboard has made it necessary to make deep cuts and tunnels to shorten our railway lines, so that larger engines and cars might pass over our roads. It has been necessary to strengthen foundations and build stronger bridges in order that the heavier trains might safely pass with their millions of tons of freight. The necessity for cheaper commodities in larger quantities to meet the demands of our growing population; the necessity of cheaper and better steel in order that our bridges might be built, our great buildings put up, and a hundred other like reasons, so closely related and inter-twined as to be almost inseparable have demanded the perfection of every means for extracting raw material, or handling and placing ores and finished products, such as ores, fuel, stone and other material. All this has brought to bear a pressure which has rapidly developed pneumatic machines for cheapening the cost of manufacture by more rapid working and a reduction or elimination of hand labor. In this connection should be mentioned the perfection of the rock drill; the development of special forms of channeling machines for getting out stone from quarries; the development of the air power coal mining machine and various other pneumatic appliances, such as pneu-

matic tools, hoists, and so on, in almost endless variety. Above all it has demanded the perfection of the air compressor, which is the heart of the compressed air installations. All of this experience has also definitely established the necessity for concentration of power generating units in order that "fixed" and "general expenses" can be reduced to a minimum and the necessity for skilled hand labor be brought to the smallest point.

We see on all sides examples of this, especially in the electrical field, where formerly small high speed engines belted to small generators were employed, possibly one-half dozen in one community, to light and run street cars, now we have a central station with long lines spreading out through the same property and supplying even more power at less cost and with less risk. It is exactly so with the use of compressed air, although the central station idea is only now where the electrical central station was ten years ago.

How many instances can be recalled where a steam boiler and engine is used to operate a hoist; 200 feet away in another boiler and engine driving a crusher; just beyond are other boilers, driving rock drills, pumps, etc., each requiring efficient care and being subject to a liability to accident and a constant depreciation in value, not to mention the waste of fuel and supplies. To-day this is changing and the central station idea is receiving the attention its worth warrants, and the time is not far distant when we believe very many large plants will be in operation in addition to those now running regularly.

The old idea that compressed air is an enormously expensive medium for power transmission is erroneous. The real truth of the matter is coming to light and gradually compressed air is assuming the position it deserves. Especially is this so in the case of quarrying, where, without any intention of hurting the feelings of our readers, we are forced to admit that very primitive and wasteful methods are still employed, at least in the majority of cases.

Referring back to the classification into which we divided central air compressing plants, an example of the first class, "Mining," is afforded by the Anaconda Copper Mining Company's several installations, which together have a capacity of about 70,000 cubic feet of free air per minute or a rated output of 42,000,000 cubic feet in 10 hours.

One of these, the Never Sweat plant, at Butte, Montana, is close to the largest air installation in the world. Under one roof are here found three compressors made by the Ingersoll-Sergeant Drill Company. They are of the Corliss type and two of them have steam cylinders 24 and 44 inches in diameter, with a 48-inch stroke. The air cylinders are Piston Inlet type 24¼ inches in diameter by 48 inches long. At 70 revolutions each of these compressors has a capacity of 3422 cubic feet of free air per minute.

The third compressor, while the same style and type as the others, is much larger in size. Its steam cylinders are 30 and 56 inches with a 60-inch stroke. The air cylinders are compounded, being 30¼ and 50¼ inches, also with a 60-inch stroke. The three compressors have a capacity of 15,338 cubic feet per minute, but are usually run to furnish 14,000 cubic feet.

This air is piped to three mines, the Never Sweat, Anaconda and St. Lawrence, where over 300 Ingersoll 3 3-16-inch drills are operated. Other uses are opening chute doors, for which purpose 50 — 10" x 30" air hoists are employed, and operating pumps and air hoists as follows:

4 — 10" x 7" x 5" x 10" Knowles sinking pumps,

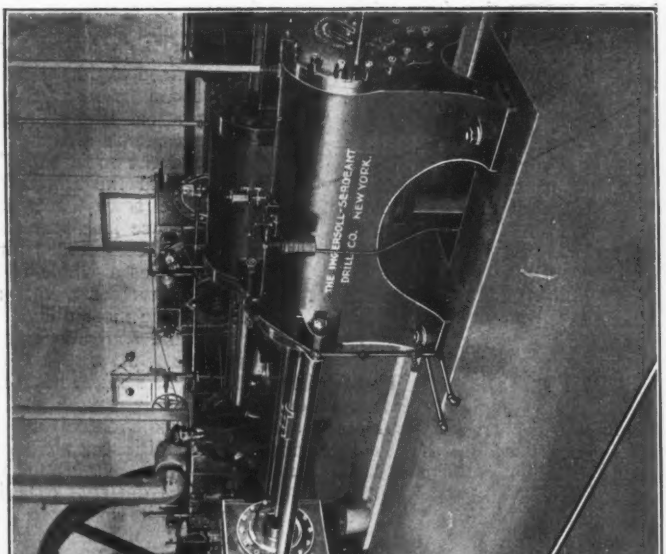
4 — 14" x 26" x 34" x 24" Knowles duplex pumps, also,

3 — 16" x 30" direct acting hoists and
40 — 5" x 5½" timber hoists.

There are other incidental uses, such as blowing out drifts to clear the air after blasts, blowing forges and other uses which are always found about a mine as soon as air is "on top".

To illustrate the second class, "General Contracting," we could name a fair-sized list of compressed air plants, as there are a large number of such plants to choose from. Two will, however, suffice.

The first of these, the Chicago Drainage Canal, is known in a general way the world over as one of the great engineering undertakings of modern times, a work made possible by the use of compressed air. Without going into details it will suffice to bring to mind the fact that the canal involved the excavation of a channel 35 miles long by



CENTRAL COMPRESSED AIR POWER PLANT, ANACONDA COPPER MINES, BUTTE, MONT.

160 feet wide and 35 feet deep and called for the handling of 39,972,762 cubic yards of material, 12,071,668 cubic yards of which was solid rock.

Possibly a better idea is given when it is told that the waste and spoil removed and piled along 35 miles of canal would, if put into pyramids, build half a dozen the equal in all respects of the great Cheops of Egypt; the thing immense, so often used as a measure for comparison.

Among the various machines used in this undertaking directly related to compressed air should be mentioned 15 large air compressors; 88 channeling machines for cutting the vertical faces or sides throughout the rock section; 15 steam or air hoists; 85 steam or air pumps and 243 steam or air drills. In passing we might note that the Ingersoll-Sergeant Drill Co. furnished a total of 170 machines, made up of 34 channelers, 129 rock drills and 7 air compressors.

One of the typical sections employed a central compressed air power plant working an 18" x 20-¼"x 36" Duplex Corliss Compressor and various types of air machines. A record taken over a period of the two summer months June and July was as follows:

Tons of coal used, 333.25.

Cost of coal at $1.70, $566.78.

Number of cubic yards of solid rock excavated in the same period, 147,085.

Coal used per cubic yard of rock excavated, a little over 4½ lbs.

In the report of the Board of Trustees having in hand the construction work, under date of August, 1895, we read:

"Powerful machinery for digging and hoisting, steam shovels, excavations, inclines, conveyors, derricks, cantilevers cableways, channelers, steam drills, pumps, etc., multiplied the effective productiveness of human labor, so that contractors were encouraged to pay fair wages to laborers, mechanics and artisans."

It must be borne in mind that much of this machinery was driven by compressed air.

A second instance, and one of perhaps more interest, in that it is at present in active operation, is the construction of the Rapid Transit Railway System in New York City.

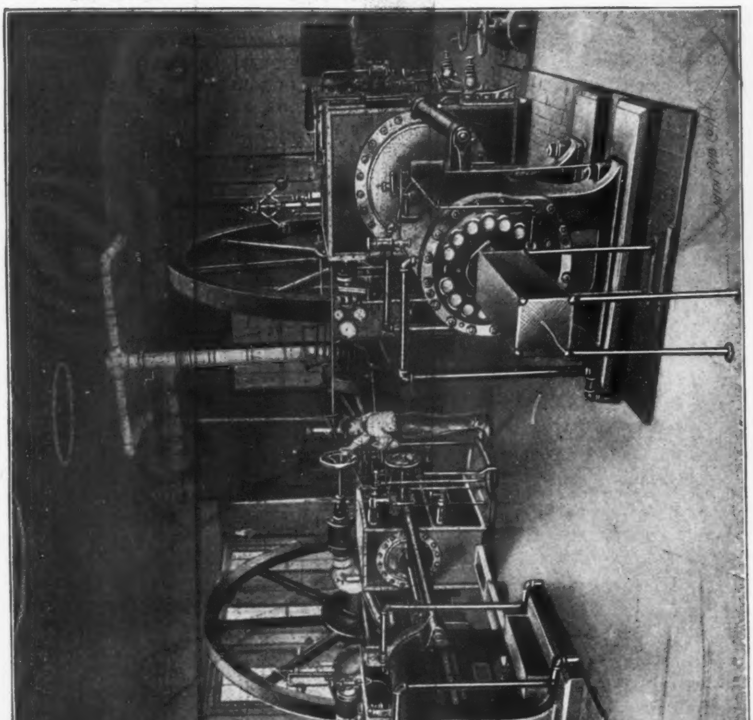
Beginning at the very end of Manhattan Island, close to the old Castle Williams, this most interesting railway is being burrowed, channelled and tunneled under streets and houses, from end to end of the long, narrow island. Branches, sidings, and stations are all to be under ground, where an uninterrupted railway system, a rapid transit road in real earnest can be maintained without interrupting street traffic or causing annoyance to residents along the line. At the upper end the main lines paralleling the Hudson, and the Bronx or Eastern branch, change from underground to a viaduct and hence lose some of their attractions to the compressed air engineer. But the system as a whole is most interesting and involves a vast amount of excavation of the most difficult character, amid a thousand annoying obst cles. City traffic and the whirl of New York's busy life could not be stemmed and must be interrupted only slightly. A great work, involving the expenditure of $35,000,000, amid these conditions, called for the highest grade of engineering skill and knowledge obtained from past experience.

Compressed air was selected as the power medium for construction purposes and from end to end of the great work, which is being pushed at every point, pumps, hoists, drills. and other apparatus are being driven by compressed air.

In all there are seven (7) Central Compressed Air Plants from which pipes are run, in some cases a couple of miles along the work. Air at from 80 to 100 lbs. is thus on tap and always ready for whatever work is to be done. It is estimated that about 400 rock drills are in this way daily at work. Hoisting engines and conveyors to the number of perhaps 75 or 100 also use their share of air, and pumps, concrete mixers are other uses, while pneumatic hammers are called into service for riveting up the steel structure.

A summary of the material involved is of interest, and is given, as it is all handled in one way or another by compressed air apparatus.

Excavation, 369,450 cubic yards.
Concrete, 75,660 cubic yards.
Brick, 11,105 cubic yards.
Steel, 8,105 tons.
Granite, 2,285 cubic yards.
Piles, 117,925 lineal feet.
Ribbed Tiles, 12,440 square yards.
Plaster, 88,190 square yards.



CENTRAL COMPRESSED AIR POWER PLANT, JEROME PARK RESERVOIR, N. Y., J. B. MCDONALD, CONTRACTOR.

Waterproofing (asphalt coating), 117,-980 square yards.

Artificial Stone, 6,790 square yards.

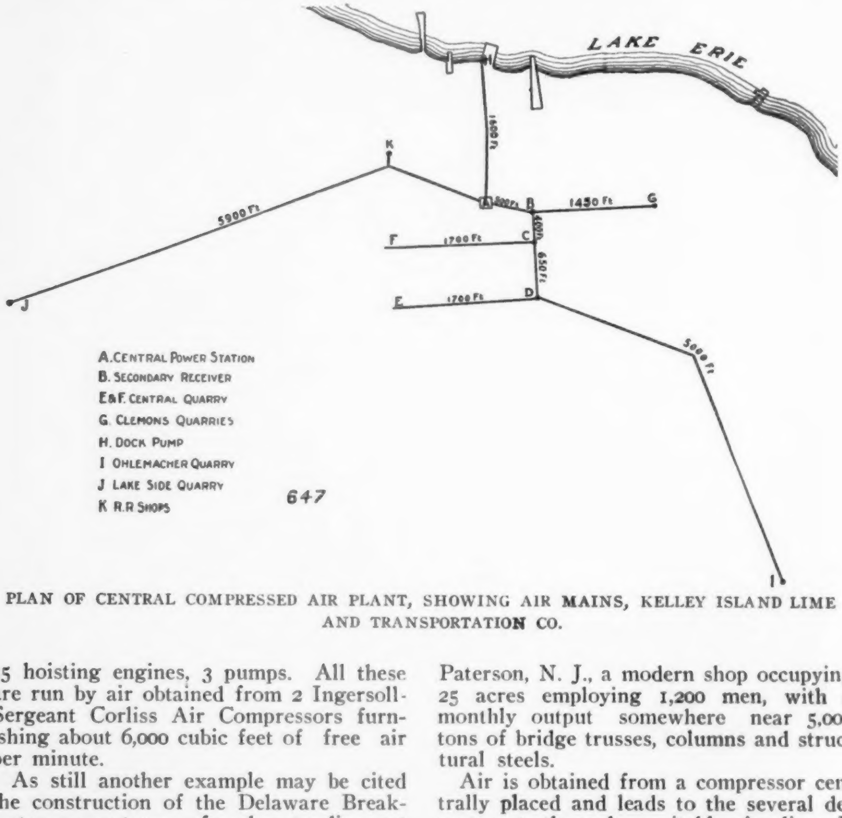
Enameled Brick, 2,210 square yards.

Enameled Tiles, 2,855 square yards.

Another central air plant of this general character is at the great Jerome Park Reservoir, where an area 5,800 feet one way and 2,800 feet the other is being excavated and walled, a work involving the removal of about 3,200,000 cubic yards of solid rock and employing 40 rock drills, 35 hoisting engines, 3 pumps. All these are run by air obtained from 2 Ingersoll-Sergeant Corliss Air Compressors furnishing about 6,000 cubic feet of free air per minute.

As still another example may be cited the construction of the Delaware Breakwater, a great arm of rock extending out 8,000 feet into the turbulent water of the Delaware Bay where its waters meet the ocean. This is a contract necessitating quarrying, transporting and placing in rough water 1,384,410 tons of rock, all of which must be of large size. In the quarry, located 75 miles from the work, air is compressed by an Ingersoll-Sergeant compound Corliss compressor and regularly operates 9 McMyler Derricks, 20 rock drills, 12 hoisting engines, 20 derricks and a number of pumps, an outfit capable of handling about 3,000 tons of rock each day.

Turning to the third class, "Machine Shop Plants," an important and rapidly growing branch, one instance will suffice. The Passaic Rolling Mills Company, at Paterson, N. J., a modern shop occupying 25 acres employing 1,200 men, with a monthly output somewhere near 5,000 tons of bridge trusses, columns and structural steels.



PLAN OF CENTRAL COMPRESSED AIR PLANT, SHOWING AIR MAINS, KELLEY ISLAND LIME AND TRANSPORTATION CO.

Air is obtained from a compressor centrally placed and leads to the several departments through a suitable pipe line. It is tapped off here and there and used to run transfer tables, beam rolls, hot saws and other special devices. In addition there are about 40 cylinder hoists, 12 pneumatic riveters, 5 drills and reamers and several chipping tools. In the case of

the rolls four men now do the work formerly requiring thirteen. This instance is only one of the many economies they have been able to institute since installing the air equipment.

One of the most recent developments in the central compressed air power plant, is the adoption of this system in quarries. Centralization of all means of generation of power is the keynote of this change. The economy resulting from a considerable reduction in wastes of all sorts, avoidance of any necessity to transport fuel or water all over the workings, the freedom from smoke, ashes and danger, but, above all, the great saving in time and money made possible by the convenience of having your power on tap, and the cheaper production of power. These are the features responsible for this new and important branch.

One of the best examples of this class of station is that of the Kelley Island Lime & Transport Company at their Marblehead, Ohio, quarries. The Compressor in this instance also is an Ingersoll-Sergeant machine of novel design, in that the ordinary square rimmed fly-wheel is replaced by an 18 foot belt wheel with a 52 inch face from which is driven a counter-shaft in turn driving four large crushers and several pulverizers, mills, etc.

Behind and in line with the steam cylinders are two air compressor cylinders furnishing about 350 horse-power of air at a pressure of 116 lbs. to the square inch.

The engine is of the Corliss Duplex type, each side having a horse power of 500, making a total of an even 1,000. Either side can be operated when less than full power is wanted or both run at the same time.

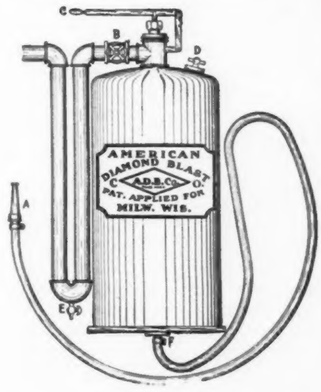
The compressed air is led off in pipes to five quarries which are included in the Marblehead property of this company. Some of these are within a few thousand feet of the compressor and one over a mile away. Another is a mile and a quarter away in a different direction. In each of these quarries are rock drills, pumps, hoists and like apparatus. All in all, there are several miles of uncovered air pipe, and while no trouble from freezing was anticipated, provisions were made to remove the entrained moisture. No trouble has been experienced and the plant has demonstrated its efficiency beyond dispute.

Many other plants of a similar character to those mentioned are under consideration as a result of the success attained with central compressed air production, and we believe that there are dozens of quarries in which air can be employed to work marked economies.—*Granite.*

A New Sand Blast Machine.

One of the latest and most simple appliances for the use of compressed air is the sand blast, which is being put on the market by the American Diamond Blast Company, of 829 Seventh avenue, New York City.

The accompanying cut gives a good idea of the apparatus, which consists of a cylinderical tank 14 inches in diameter by 26 inches high and the necessary valves.



The sand (ordinary sea or lake sand) is poured into the tank through a hole in the top, for which a suitable cap *D* is provided. The 1-inch air pipe forms a U before entering the tank and a drain cock is placed at its lowest point. The pipe then extends down through the centre of the tank and the flow of sand into it is regulated by the lever *C*. The hose connection at the bottom is about 9 feet long and terminates in a ¼-inch nozzle. For operating, the air valve is first opened and the flow of sand is then regulated to any desired extent by the sand valve. It is claimed that any pressure from 20 to 100 pounds per

square inch can be used, the force of the blast varying, of course, with the pressure. Under ordinary conditions, with 70 pounds pressure the cylinder full of sand will last for about an hour of continuous operation.

This blast is applicable for many purposes. On glass it can be used to cut designs or letters, for frosting and for boring holes of various sizes; on metals, for removing scale from forgings, for cleaning vessel hulls, structural work, castings, especially small ornamental ones, previous to gold, silver, copper, and nickel-plating, and for removing paint and rust; on marble, granite, stone or brick, for cutting designs and letters, removing tool marks, discoloration and weather stains, particularly in monumental work and on buildings.

The templates used in cutting letters or designs are furnished by the makers of the blast, and are formed of a special alloy to withstand the hard usage to which they are subjected. They will last for about 75 operations, and are said to be very cheap. They are glued on the marble, granite or glass and the material around them is blown away, leaving a raised figure of very neat appearance.

All of the work done by the apparatus is accomplished very rapidly, it being a matter of only a few seconds to clean thoroughly very dirty stone or brick or extremely rusty iron. Letters three-eighths of an inch high can be cut in granits or marble in one minute, and holes bored through thick glass in 15 to 20 seconds. There seems to be no question about the rapidity or thoroughness of the work done, and the only matter to be determined to insure the extensive use of this blast is whether it will save enough in labor to pay for its installation and the operation ot the compressor which is required.

The blast is on exhibition in New York, Pittsburg and Milwaukee.

The Vollkommer Pneumatic Conveyer and Run-out for Band and Skelp Iron.

At the works of the Union Iron & Steel Co., Youngstown, O., before they were acquired by the American Steel Hoop Co., much trouble was found when rolling long pieces, in getting the pieces away from the mills rapidly enough and in keeping them straight. The pulling out of the pieces by boys limited the lengths of the band and the speed of the mills, thus limiting the production, and on hot days the boys refused to work. The roller conveyor, of which several of different types were tried, while better than pulling by hand, necessitated frequent repairs and stoppages, worked too slow and were unfit for long bands. These troubles were overcome by pneumatic conveyors, which were a success from the start. A pneumatic conveyor was installed, 375 feet long, at a cost of less than $5,000, against the competition of a roller conveyor estimated at $25,000. Immediately after, two entirely new roller conveyors which cost $32,000 together, were thrown out and replaced by the pneumatic conveyors. At present the American Steel Hoop Company has eight such conveyors in use, and more are under construction.

The principle is simple. Air from a fan, at low pressure, is driven into a conduit or air box from which it escapes through the air-ports in the face of running plate, forming an air cushion on which the strips are carried without friction. Theoretically, for each eight inch of thickness of the strip, a pressure of $1\frac{1}{16}$ ounce is required. In practice, however, a small excess over this pressure is needed; the narrower the strips are, the higher the pressure. In most cases the running plate is laid at the level of the mill floor, instead of having it raised as shown in the cut, and it is possible to walk or drive over it during operation. It does not obstruct the mill from rolling other shapes, as rounds and squares which may be run out in the same groove without air pressure. There is also an arrangement with a slightly inclined running plate and only one guide, which is also used as pusher to propel the strip sideways to the cooling bed; thence it slides to the shear run, where it is floated again, to lighten the work of the shear iron. In this shape the conveyor is especially adapted for skelp mills and for heavier and varying material generally.

The American Steel Hoop Company has acquired the sole right for narrow sizes, up to 8 inches, while T. J. Vollkommer, 503 Lewis Block, Pittsburg, controls the patent for wider sizes. Some of the advantages of this method of handling flat material are these: The

mill can be run at high speed; the pieces can follow each other without delay; the longest piece can be rolled, thus saving crop ends and time; maintenance, repairs and first cost are considered economical; it does not obstruct the mill in rolling other material, nor the passage way; it cools the steel rapidly and uniformly, without injury to its temper; it ventilates the mill, especially during summer, if the air is taken from outside the building. Improved operation is secured on wide sizes over narrow bands from under which the air can escape freely. Mr. Vollkommer has applied the same principle to plate conveyors and shear tables, the resulting mechanism containing several new features of merit.—*The Iron Trade Review.*

An Interesting Example of the Pohlé Air Lift System.

We are glad to be able to present for the benefit of our readers a set of photographs showing one of the latest applications of the Air Lift Pump for raising water from the ground.

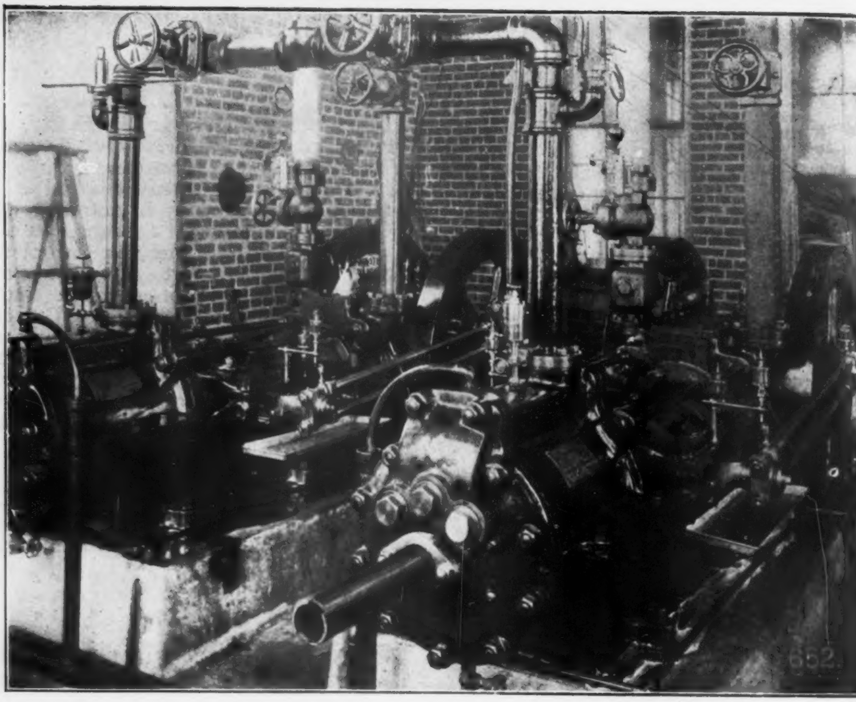
The plant in question is on the property of the Government Hospital for the Insane at Anacostia, D. C., the buildings of which stand on the brow of the hill overlooking the city of Washington. The question of obtaining an ample supply of pure water has been a problem to the authorities of the hospital for some time, and after a careful investigation of the subject it was decided to install the Air Lift System in preference to any other means of water supply. The reasons influencing this selection were the need of a permanent unfailing supply of the purest quality at the least expense, and with the least attention, and also least liability of interruption. How this was accomplished is well shown in illustrations.

A series of twelve wells were driven along the low bank fronting the Anacostia River and about 50 or 60 feet from the water's edge. These were driven from 200 to 300 feet deep and include three wells with an 8" casing and five with 6" casing. In addition there are four other wells with a 2" casing scattered about the ground. Along the line thus established was buried an 8" cast iron water main with an elbow and riser at each well, clearly shown in the illustrations. From about midway of this row of wells a 12-inch cast-iron water pipe is run at right angles to a covered brick reservoir of a capacity of about 100,000 gallons, which is under the power house. The risers in the pictures are about seven feet high, or just sufficient to produce head enough to carry the water over and into the reservoir. The arrangement of these wells, the sizes of piping and the position of the compressor power plant are all clearly shown in the plan on page 1656. In all there are twelve wells using the Pohlé Air Lift device with a 2" water pipe and a 1" inch air pipe. Each of these Pohlé pumps is guaranteed to lift 400,000 gallons of water in twenty-four hours and deliver this into the reservoir, provided the water level in the wells does not drop lower than 70 feet below the ground when pumping. This gives a total lift to the reservoir of 77 feet, with a submergence of 115 feet, or a total length of water pipe of 192 feet. It was found by experiment that each of these wells when pumped at the rate of 50 gallons per minute maintained a water level of 30 to 40 feet below the ground surface, and when standing idle the water rose to within 20 feet of the ground surface.

Air for pumping the wells is obtained from a duplicate plant consisting of two Class "A" steam actuated compressors of the Ingersoll-Sergeant "Straight Line" type with steam cylinders 12" dia. and a 14" stroke and air cylinders 14¼", also with a 14" stroke. One of these compressors is found sufficient to operate all the wells and the other is held in reserve. The compressed air passes off into a 42" x 8' high vertical air receiver by which it is carried through a 3" pipe to a 2" air main running parallel with the line of wells.

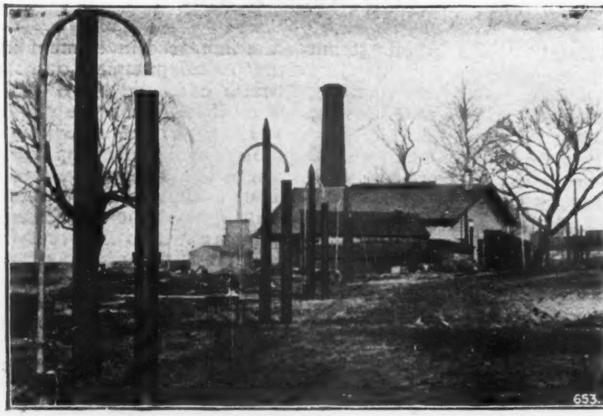
The first view illustrates the interior of the compressor room showing the two Ingersoll-Sergeant Class "A" Compressors, side by side, and affords an idea of the compact and solid character of these machines.

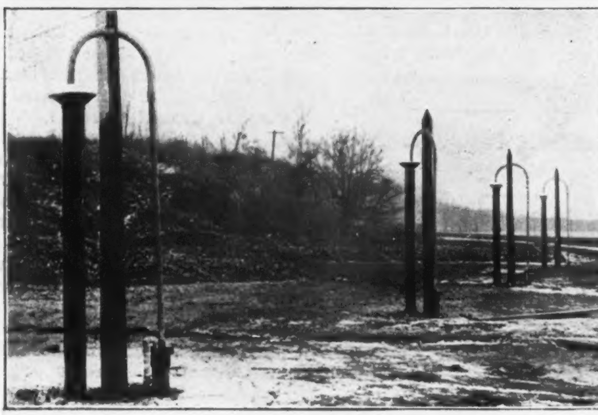
The frontispiece shows the exterior of the power plant showing nine of the wells, some of which can be seen in full operation. This and other pictures clearly show the risers which are used to give a head sufficient to force the water into the reservoir, from which it is raised



COMPRESSOR PLANT AT THE U. S. GOVERNMENT HOSPITAL FOR THE INSANE, WASHINGTON, D. C.

PLAN OF POHLÉ AIR LIFT SYSTEM, U. S. GOVERNMENT HOSPITAL FOR INSANE, WASHINGTON, D. C.





POHLÉ AIR LIFT PUMPS, SHOWING COMPRESSOR HOUSE, AIR, WATER AND DISCHARGE PIPES.

to the building by the usual steam pump.

The water pipes can also be seen rising above the discharge pipes and curving over with a long sweeping bend.

The cuts on page 1657 give other views of some of the wells and clearly show the novel method of obtaining a head.

The view from the other side of the power house, shows the line of wells stretching off into the distance. In the foreground and at the right of the picture one of the wells is shown in detail and the casing, air pipe, water pipe, supporting column and discharge pipe can be clearly seen.

We are indebted to Mr. John Berrall, C. E., of Washington, D. C., who was consulting engineer for the Government in the plant for the material from which this description was prepared.

Some Information in Regard to Air Lift Pumping.

EFFICIENCY OF THE AIR LIFT.

The efficiency of the Air Lift Pump is high when compared with other means of raising water from artesian or deep wells. Considered by itself and taking into account the energy contained in the compressed air efficiencies from 70 to 85% are not uncommon in properly piped wells. A wide experience has shown that an over-all or working efficiency as high as 52% is obtained and an average may be expected very little under this with favorable conditions.

The efficiency of any device is more or less relative and involves the consideration of a number of factors. Any apparatus containing working parts will in the long run be less efficient than one with no parts to wear, other things being equal. In addition to its real efficiency, the Air Lift System possesses as its most desirable feature its entire freedom from working parts. The depreciation of a working machine is considerable, the constant expense for packing oil and other supplies, the constant call for attention and repair, the liability to shut down, or accidents due to exposure, all of which are necessary evils with any other form of pump are avoided in the Air Lift. These added to the interest on the increased investment in the case of a deep well pumping outfit will make the water cost you more, gallon for gallon, than if raised by the Air Lift.

If this is the case with a single well, how much more important is it where there are several wells scattered about over a considerable area. With the Air Lift, an air pipe to each well and a water pipe from it to the reservoir, an efficient air compressor housed wherever convenient, complete the equipment; a small first cost and next to nothing for repair and maintenance is the record.

Many cases arise where the application of a very little power in the form of compressed air will be of the greatest service and convenience and where in fact no other means could be employed with anything like the same satisfaction or economy.

An instance of this is afforded by an electric light plant which recently came under our attention in which water for condensing purposes is obtained from an artesian well. The water in this instance flows with natural pressure to within a few feet of the ground surface, and it was necessary to pump from this level for circulating purposes. Recently they have constructed a reservoir just high enough to cause the water to flow through the circulating system by gravity and the pumps have been replaced by a small-size compressor used to operate an Air lift. An air pressure of a few pounds is quite sufficient to raise the water the amount necessary to cause an ample gravity flow. Just what the saving in this case will be is not at present known, but an electric pump has been replaced by a small compressor in the engine room requiring considerably less power operating only intermittently, and the service rendered independent of the operation of a pump as the reservoir has a capacity to operate the plant for some time.

OTHER APPLICATIONS OF THE AIR LIFT.

In addition to it use for raising water, compressed air lends itself with remarkable facility to the difficulties involved in handling brine from salt wells, for raising sulphuric acid, acid solutions, and other commercial liquids of high specific gravity and corrosive character. In manufacturing establishments, it is indispensable for ore leaching, handling dye,

paper, pulp and fluids. In sugar refineries or any place where gritty particles and chemical solutions are encountered and for many other purposes which will suggest themselves, the Air Lift has no equal.

There are no working or moving parts of any sort in contact with the liquid, and in consequence the few pipes and tanks necessary for storage and moving the liquid can be made of materials unaffected by the fluid.

A Pneumatic Press.

The accompanying sketches, Figs. 1 and 2, represent a pneumatic press that is in use at a railroad repair shop at Toronto, Ont. It has proved itself a very useful

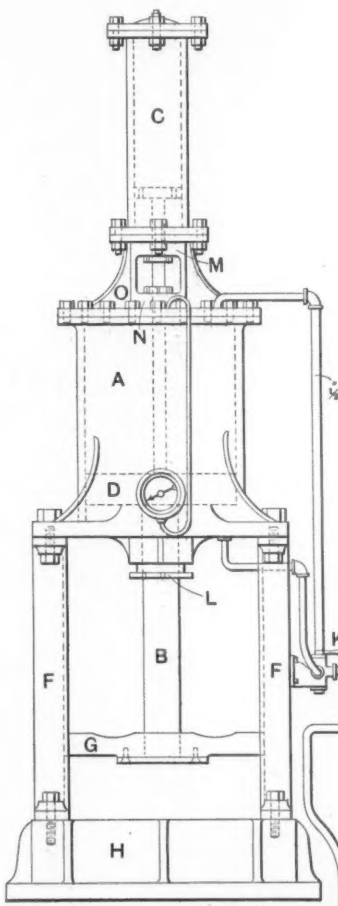


FIG. 1.

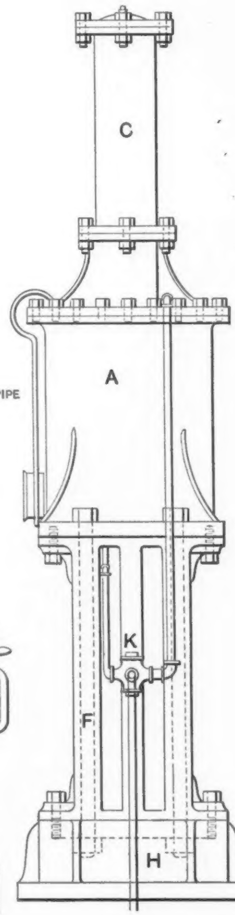


FIG. 2.

adjunct to the shop for pressing in side-rod bushings, axle-box brasses, etc., so that I think it will be of interest to our readers.

It consists of an air cylinder *A* acting upon the ram *B*, and a dashpot cylinder *C*.

The air cylinder is 30 inches long and is bored to 20 inches in diameter. The piston *D* in the air cylinder is cast in one piece with its piston rod or ram *B*, the latter being bored out. The packing used on this large piston consists of ordinary snap rings. The small cylinder *C* at the top is of the same stroke, but only six inches in diameter, and is permanently filled with oil. Its piston is also of cast iron, and is connected to the large piston *D* by a 1½-inch steel piston rod, which passes through the two stuffing boxes *M* and *N*. The small piston has two holes through it, as shown by dotted lines in Fig. 1, through which the oil in the cylinder passes when it is moving up or down, impelled by the large piston in its movement. Thus it acts as a cushion or dashpot to prevent sudden dropping of the heavy ram to the bottom of the cylinder when a bushing or brass has been pressed out of the work.

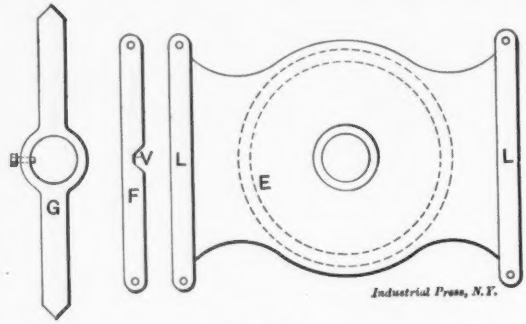


FIG. 3.

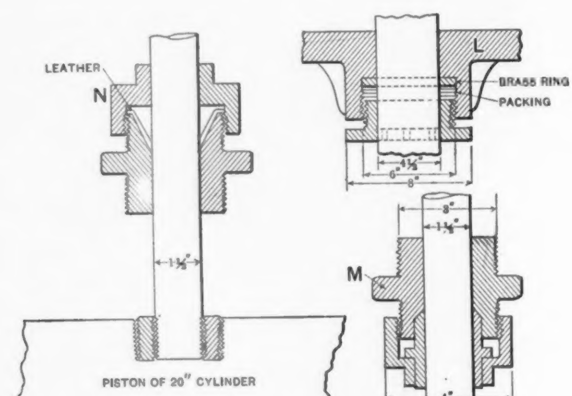


FIG. 4.

E, Fig. 3, is an end view of the lower end of the large cylinder casting *A*, show-

ing the lugs cast on by which to fasten it to the supporting columns *F F*, Figs. 1 and 2. *F*, Fig. 3, is a cross-section view of the supporting columns *F F*, which besides acting as supports serve to guide the cross head *G* on the lower end of the ram. V-ways are planed vertically on the insides of the supports, as shown at *V*, to correspond with the ends of the crosshead *G*. These columns *F F* are bolted down to a heavy cast-iron base *H*, upon which the work rests while being operated upon, and which serves as a base for the press. A combination head *O* is used to connect the dashpot cylinder *C* to the top of the air cylinder *A*, and it is in this casting *O* that the stuffing boxes *M* for the bottom of the cylinder *C*, and *N* for the top of the cylinder *A*, are inserted. The three-way cock *K*, Figs. 1 and 2, is connected up with one-half inch pipe, so arranged that the operator can admit air pressure on either side of the piston to raise or lower it. A pressure gage is connected to the upper end of the air cylinder and located handily at the front of the press. The air pressure usually carried at the shop is 80 pounds.

In Fig. 4 are shown in section the different forms of stuffing boxes used on the press. *N* is the stuffing box used at the top of the air cylinder *A*, in which a conical leather bucket-ring packing was found to be most satisfactory. *M* is the stuffing box used at the lower end of the oil cylinder, and *L* is the one used at the lower end of the air cylinder on the large ram *B*, which is 4¼ inches in diameter. As may be seen in the sketch, Fig. 4, *L* is packed with a flat ring packing backed up by a brass ring at the top.

With this press work can be much more uniformly fitted than by the usual methods of using a screw or, as is most frequently the case, "main strength and a sledge hammer." Also a very great saving of time is effected by its use. An interesting fact in this connection is that prior to its use much difficulty was experienced in getting a fitter to remain long on a job of fitting axle brasses, for the reason that the work was too laborious; but now no trouble of this kind is met with, the fitters, in fact, preferring the job of fitting to other jobs. The press will not be found to be expensive to build especially in consideration of its usefulness.—*Machinery.*

A Few Words About Air Compressors.

In every mechanical system there is one feature or part of greater importance than the others, on the proper operation of which depends the working of the entire outfit.

In an electric street railway, the failure of one car does not of necessity prevent the working of the entire railway. Should, however, the dynamo give out, the road is tied up. The Air Lift system of raising water from artesian and deep wells has for its chief part an efficient and durable air compressor. In this connection we wish to call attention to the fact that Dr. Pohlé, the inventor of the Air Lift System, associated himself with the Ingersoll-Sergeant Drill Company as manager of its Air Lift Department, a position he held until his death.

As the efficiency and satisfactory working of an Air Lift outfit rests upon the character and operation of the machine for compressing the air, you should make no mistake in the selection of your air compressor.

Low first cost is an argument always used by makers of cheap machines, and too frequently listened to by the average purchaser. Low first cost usually means poor grades of material, cheap work, and a design admitting of cheap construction, but resulting in inefficient operation, frequent expensive repairs and final dissatisfaction, frequently causing condemnation of the entire system, when the compressor alone was at fault.

Delays through breakdowns are costly in the double sense of repairs and inconvenience from the failure of the water supply. In the case of municipal water works, shut-downs throw the community open to serious danger from fire.

The question of repairs and uninterrupted continuance in operation are quite as important as efficiency and warrant any extra cost necessary to secure a high grade machine. The old saying, "The best is the cheapest, irrespective of cost," is true of air compressors, as well as any article.

AIR RECEIVER.

All practical air compressors use the straight cylinder with a reciprocating piston and make two compressive impulses per revolution of the air com-

pressor. With duplex machines, employing two cylinders, there are four impulses per revolution, but even this produces in the pipe line a series of pulsations corresponding to the strokes of the piston. If air pulsating in this way is used in a well, it is impossible to obtain the best efficiency, or even satisfactory results.

For this reason an air receiver is inserted between the compressor and the well, usually close up to the compressor, and the air as compressed in the cylinder passes into the receiver, where it accumulates and acts as a spring to absorb the pulsations. The air then issues from the received outlet in a steady stream at the desired pressure.

The receiver should stand on end within 20 to 50 feet of the compressor with the discharge from the compressor connecting at the upper opening and the air main leading from the lower opening off to the wells. A tight gate valve should be on the main just beyond the receiver, but there should be no valve on the discharge pipe between the compressor and receiver, except where two compressors are connected together and compress into the same receiver, in which case a Poppet Safety Valve should be placed on each discharge pipe, between the compressor and the gate valve.

Horizontal receivers are also used where conditions preclude the use of the vertical type or make the horizontal form advisable. but the vertical form is usually preferred.

The receiver can be either in the engine room or outside, whichever is most convenient, but the safety valve of the receiver should be piped back inside the room to prevent its freezing tight. If the air line is long and is feeding a number of wells it may be advisable to put another receiver or receivers along the line. These receivers should all be provided with pressure gauge, safety valve, and drain cocks, and the line itself, especially if long, should have at intervals, particularly at low points, a valve to blow off any moisture which may collect in the pipe.

The use of large receivers with an idea of storing the air up as in a reservoir is incorrect. The amount of air which can be stored is slight compared to what is needed in the average well. The correct plan is to select a compressor of a size sufficient to supply all the air needed and some to spare. When the demand for water falls off the compressor can be run slower.

These receivers are usually made for 110 lbs. working pressure of the best 60,000 pounds t. s. with side seams double riveted and dished heads. They are tested to 165 pounds water pressure, and are warranted safe and tight under a working pressure of 110 pounds. They are fitted with manhead, safety valve, pressure gauge, drain cocks and flanges for inlet and discharge pipes. They are made either horizontal or vertical, the only difference being that the vertical type has a base ring which is omitted from the horizontal form.

Compressed Air for Operating Other Pumps.

Aside from the simple Pohle Air Lift there are six other systems for raising water in which compressed air is used as the working medium.

1. Displacement Pumps—full pressure.
2. Displacement Pumps—Expansion.
3. Direct-acting Pumps—full pressure.
4. Direct-acting Pumps—Expansion.
5. Air Lift Pump—combined with displacement pumps.
6. Pumps operated by air motors.

The simplest of these is the displacement pump for direct and full pressure. In certain industries acids and commercial liquids have been transferred for some time by air pressure acting on the surface of the liquid confined tank, and strainers and agitators are often used in a similar way.

The principle has been extended more recently to a form of displacement pump for raising and forcing water from a distance when the source is a pond, dug well, river or other surface supply. The same apparatus, in a slightly modified form is also used to raise acids and heavy chemical solutions or to lift sewage to a higher level; for pumping, marl, paints and other semi-liquids.

In its simplest form the device consists of two chambers of a material unaffected by the liquid to be handled and submerged in the liquid. The chambers fill alternately through openings in their bases and the material is forced out through a common discharge by direct air pressure, acting without the friction, leakage and wear incidental to piston pumps. The valves for alternately filling and emptying the chambers is above the

liquid surface and where it cannot be affected by direct contact or by any fumes or corrosive gases given off.

The height to which water can be raised by this means is limited only by the pressure of the air used to operate the pump, and the quantity raised will in a like manner depend upon the volume of air forced into the chamber per minute. These pumps are built in sizes up to 1,500 gallons per minute for all varieties of service, such as draining sumps or dips, for which purpose they are unsurpassed, because of their automatic starting and stopping—according to the presence of absence of water. They use air only in proportion to the accumulation of water.

They form a very reliable pump, use no oil nor packing, are unaffected by grit and repairs are insignificant, there being practically no repair nor maintenance expense when once they are installed and adjusted.

The system lends itself most satisfactorily to small municipal water works and effects noticeable economy, the water being supplied to the pump cistern from wells by the air lift, using the same air plant for the two purposes. All other pumps are thus done away with, no standpipe is required, the steady elastic air pressure forcing the imprisoned water into the service mains in a continuous stream. The whole system is efficient, simple, self-contained and economical in first cost and cost of operation.

With air at 90 lbs. pressure per square inch, allowing for pipe friction, air absorbed by the water and a small addition necessary to cause the flow, it is safe to assume nine (9) cubic feet of free air for each cubic foot of water pumped to an elevation of about 210 feet, as approximately stated.

With the displacement pump one (1) *cubic foot of free air at* 90 *lbs. pressure will do* 175 *foot-gallons of work.*

The efficiency of this system, employing ordinary single stage air compressors and lifts not exceeding 250 feet is greater than that obtained with the usual direct-acting single cylinder pump using air instead of steam.

If compound compression or two or more stage compreesson is used better results may be expected, especialy if the water pumped is warmer than the air arriving at the pump. Generally speaking, the efficiency in this case may be taken between 15% and 22%.

Compressed air can also be used to operate steam piston pumps, and when these are located outdoors some distance away from the boilers it will run them with greater economy than can be done with steam, because of the rapid condensation of steam in the exposed pipes leading the steam to the pumps. Authorities estimate that with coal at $2.00 per ton every foot of uncovered two-inch pipe costs by condensation about $1.00 per year, and even with covered pipes, when long, the condensation is a considerable factor.

In addition there are no hot pipes, becoming leaky through alternate contraction and expansion. There is no exhaust to dispose of, the pumps take less oil, are more reliable and last longer.

Even under favorable conditions a steam pump is not an economical machine, and the simple direct-acting form is known as the least efficient of all steam users and hence air users, as a result of the large clearance space and the impossibility of maintaining a full stroke, besides the considerable condensation which unavoidably occurs.

The average mechanical efficiency of the pump alone will be about 65%, although in many cases 50% is nearer the mark. The total over all efficiency, from steam used to water raised, will average nearer 12% to 20% in most plants, as actually operated.

By means of compounding and reheating or interheating the air, better results are obtaind, the average running up to from 15% to 30%. Experience has shown that for average conditions using air at 90 lbs. pressure per square inch, *one cubic foot of free air will do approximately* 135 *foot-gallons of work.*

On the basis 111 cubic feet of free air will be required to raise 150 gallons 100 feet high per minute, and assuming 20 delivered horse-power necessary to compress 100 cubic feet of free air per minute, we have 1.1 x 20, or 22 horse power.

In the case of pumps working either under full pressure for the full stroke, or expansively, there is a liability to "freezing up" in the exhaust passages and ports or at the exhaust, an annoying and sometimes serious matter. Two general ways to avoid this are adopted, one to

spray a small jet of water taken from the pump discharge directly into the exhaust of the air cylinder, a rough and ready means, but one that works well.

The second and better method is to use compound pumps which permit the introduction of an air heater between the cylinders, besides having a higher mechanical efficiency of 70%.

This interheater is a copper coil immersed in a tank of running mine water. Or it may be a regular feed water heater put to this use. The exhaust air, usually much colder than the mine water, absorbs sufficient heat from it to allow a second expansion in the low-pressure cylinder without carrying the exhaust temperature below the freezing point.

The average total efficiency to be expected with this arrangement is about 33%, while if in addition the air is obtained from a compound compressor the efficiency may reach 38%.

For purposes of comparison we may assume that:

One cubic foot of free air compressed to 90 lbs. per square inch will do 232 foot-gallons of work.

The application of reheating and other methods of increasing the efficiency of pumping or air-driven power outfits depends to a considerable extent upon local conditions.

The Sanitary Drainage of Houses and Towns.

PNEUMATIC SYSTEM.

We see in turn all the elements being called upon as aids in the drainage of town and village, for while before we had earth and water employed, we now, in our new system, seek the aid of the air we breathe, in the removal of refuse from our habitations. This system, which is as yet but little used on account of its recent discovery, has whenever tried, chiefly in Holland and Austria, given very satisfactory results. It is to the research and ingenuity of a Dutch engineer, Charles Tiernur, that the scientific world is indebted for the discovery of a system which is undoubtedly the greatest modern invention in sanitary science. It consists in having a number of air tight iron reservoirs, as many as the size of the town demand, sunk to sufficient depth beneath the surface to prevent freezing, to which are connected the house drains of the town. This iron chamber is at certain intervals exhausted of its air, so that when valves are opened connecting with the drains of the town the pressure of the atmosphere forces everything from the pipes down into the central reservoir. If the number of these is large they may all in the same way be emptied by a similar process into one central final vault. The chief difficulty that presents itself in this undertaking is that some pipes would eventually be emptied before others, in which case the air finding easy access through the empty drains, could no longer affect those still full. But the obstacle was early overcome by referring to the principle of equal barometric resistance. Before entering the main each house drain is provided with a break or abrupt change in elevation, of say exactly one foot. Now suppose that while one drain discharges a large quantity daily another supplies but a small quantity of sewage. Then if the air be extracted from the main, so that atmospheric pressure acts in both house drains, the liquid in the first will first descend before that in the second begins to move. Then when they have both reached the same point the liquid in both will flow out together. In the same way, no matter how great the number of drains, they will all be emptied at the same instant. The closets, as originally made, were simply the iron hopper closet, being placed, if possible, one above another, so that the fall may be nearly straight. But any other may be used equally well, provided a large sized ventilation pipe passes up through the roof by which the atmosphere may exert its full pressure on the liquids in the drain. As the sewage at the final depot is run through sieves and evaporated for use as a fertilizer, the street wash and kitchen slops are usually conveyed by a separate set of pipes into a lake or stream. The chief advantage this method has above the others is that it returns to the soil that which we have taken from it, and also the income from the sale of the product soon pays for the construction of the work, and is less expensive and more economical.—**H. G. Tyrrell, C. E.**, in *Canadian Engineer.*

Notes.

The Standard Pneumatic Tool Co. will erect a $20,000 addition to its Aurora, Ill., plant.

The Helwig Mfg. Co., St. Paul, Minn., recently shipped a number of its reversible pneumatic drills to the U. S. Navy Yard at Mare Island, Cal. Thorough tests of these machines had been made under Government auspices.

Mine tunnels in hard rock have been driven as much as 100 feet a month by hand. From 60 feet to 80 feet are ordinary rates of advance. Using power drill, as high as 300 feet advance has been made, and from 230 feet to 260 feet records of progress are ordinary practice.

The Garry Iron & Steel Company are working up a good business in pneumatic revolving cranes. They have recently sold a 5-ton pneumatic revolving crane to the Cleveland, Elyria & Western Railway, and a large special pneumatic crane to the Michigan Central Railway.

In the December, 1901, issue of COMPRESSED AIR we published an article entitled "Compressed Air as a Safe Power." Through an oversight, we neglected to give credit to the "American Engineer and Railroad Journal," where the article first appeared and where credit justly belongs.

The New York Central people are carefully inspecting their car yards to see that piping for conveying compressed air is installed so that every car may be reached. The intention is to find out the condition of the air brakes on every car that enters a yard and to hold it for repairs if necessary.

The Chicago Pneumatic Tool Company of 95-97 Liberty street, New York, are reported to have secured a contract through their British representatives, the New-Taite-Howard Pneumatic Tool Company, Limited, of 63 Queen Victoria street, E. C., calling for the shipment of over $10,000 worth of pneumatic tools to be installed in the new car shops of the East Indian Railway.

The air flasks that hold the compressed air under several thousand pounds pressure have been rapidly evolved during the last few years, so that now are produced in this country nickel steel flasks, not only twice the strength of those formerly used, but which are absolutely incapable of rupturing under the pressure used.

The plan for consolidating the various pneumatic tool companies into one company is reported as having been effected. The capital stock is $10,000,000, of which $7,000,000 will be issued. The Chicago Pneumatic Tool Company is the nucleus of the consolidation, the other companies being the Boyer Machine Co., Detroit; the Franklin Air Compressor Company, Franklin, Pa.; the New York Air Compressor Co., the Chisholm-Moore Co., Cleveland (in so far as it appertains to the business of pneumatic tools), and the Taite-Howard Pneumatic Tool Co., Ltd., of London, Eng.

The pneumatic dynamite gun mounted at Hilton Head, S. C., was officially tested on Dec. 8. Eight projectiles loaded with from 50 to 200 pounds of explosive gelatine were fired on a range of 6,000 yards. Of these six exploded on impact and two fitted with time fuses exploded at such a depth below the surface as not to be noted—if exploded at all. Five dummy projectiles in a speed test were fired in 10½ minutes, instead of 20 minutes, as required by the Government, and 40 air shots were successfully made in an endurance test. This gun was made by the Pneumatic Torpedo & Construction Co., of New York.

The meeting of the American Institute of Mining Engineers recently held in Mexico City is one of the most memorable in the history of the Institute. The hospitality shown by the officials and citizens of the Mexican Republic was generous in the extreme and all members of the Institute were much impressed with it. The full benefits of the trip will not have been realized if the American engineers have not learned

that the Mexican method of mining and ore treatment has a distinct raison d'etre. And the Mexican engineers no doubt learned much from the broad practical experience of the American engineers.

Mr. Arthur L. Smith, Pt . Huron, Mich., writes "Railway and Locomotive Engineering" of a pneumatic Belt Shifter which is very handy for shifting long-belt. He says: "In the Grand Trunk shops at this place there is a long belt, 59 feet long, 2 inches wide, where the swinging of the belt would force belt from tight pulley to loose one. With the pneumatic shifter air is on piston while belt is on tight pulley, and holds it in position. A three-way cock is used for controlling air, and the length of cylinder is varied to suit width of belt. Use ¼-inch iron gas pipe and make hole in brass cap to suit travel of shifter, usually about 1-32 inch. Use crosshead on threaded end of piston and spring to suit belt. It can be placed anywhere.

At the switching yards of the Chicago Transfer & Clearing Co., a plan is being carried out for the systematic handling and interchanging of freight cars, and the necessary plant is now practically completed and ready for operation.

The electro-pneumatic switch system, the air-lift pumping system and the tools in the engine room are all operated by three Rand Compressors. Two of these compressors, of 200 and 270 H. P., have cross-compound Corliss engines. The former supplies air at 100 lbs., receiver pressure for the electro pneumatic switch operating system, and the latter supplies air at 80 lbs. pressure for general power purposes in and about the yards. The third machine is a straight-line compressor of 225 H. P., with a capacity of 950 cubic feet of free air per minute.

The American Engineering Works, Chicago, have recently designed a small post hammer, to be operated by steam or compressed air. This hammer is particularly well adapted for all classes of general blacksmith shop work. It works very quickly, will turn out a large amount of work per day, and is thoroughly satisfactory for all forging work 2½ inches in diameter and smaller. This hammer will be found to be an extremely useful tool for railroad, blacksmith and shops generally where any forging work is required.

The action of this hammer is the same as that of a large steam hammer. The ram can be regulated to strike a blow of the full force developed by the falling weight with the momentum due to the pressure of the steam or air behind it, or it can be regulated so as to give the lightest possible blow, merely touching the object on the anvil without doing any work.

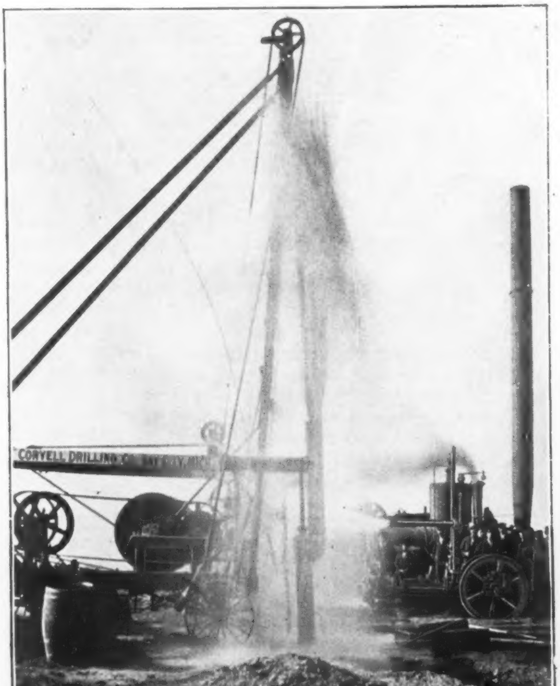
A special meeting of the shareholders of the Pneumatic Railway Signal Company was held at Rochester, Monday afternoon. Nearly all of the stock was represented. It was voted to increase the capital stock of the company from $1,250,000 to $3,000,000. Authority was given to the directors to buy the stock of one or more corporations; also to buy such other property as may be useful in the business of the company; and to issue as much of the increase of stock as may be found necessary in carrying out these transactions. Authority was given to sell all or any part of the company's property. Of course, all of this is merely preparation for some important combinations which are now under negotiation. Immediately after this meeting a meeting was held of the shareholders of the International Pneumatic Railway Signal Company, at which the necessary powers were given to enable the board to carry out the combinations under consideration.

In connection with the building of the Melbourne and Metropolitan Sewage System at Melbourne, Victoria, several peculiar accidents occurred of quite some interest. The first on a small tunnel which was being driven with shields and lined with cast iron and concrete. While traversing a locality where an old river course formerly existed, the shield dropped off the lining and sank several feet into the drift sand. Compressed air was resorted to and a chamber was opened out in the drift about 8 feet high. The shield was lifted up, put back on the end of the cast-iron lining, and Portland cement concrete was placed below it on the drift, so that it could be driven forward bit by bit until the more solid sand on the other side of the old water course was reached. An-

other case occurred where a shield was being driven to a connection with an inverted syphon. The work was being carried on under compressed air, and the contractors eventually ordered more compressing plant in order to prevent an accumulation of foul air at the face. Work was suspended while the new plant was being installed and no danger was anticipated. Nevertheless, some of the men entered the air lock during the Christmas holidays and lost their lives through a very heavy inburst of foul gas.

The Air Lift System of raising water from artesian or deep wells has ceased to be a novelty, and the two illustrations shown herewith are offered simply as an example of one installation. Many of our readers are interested in this subject, and we are confident that many others could use the Air Lift to advantage.

The plant shown is a 6-inch well at Bad Axe, Mich., drilled by the Coryell Drilling Co., of Bay City, Mich. It is operated by a 12 and 12¼ × 14-inch Class "A" compressor, furnished by the



AIR LIFT PUMP, BAD AXE, MICH.

TESTING AN AIR LIFT PUMP, BAD AXE, MICH.

Ingersoll-Sergeant Drill Co. The pictures were taken at the time of the first test of the outfit, and give a very fair idea of the way in which an Air Lift well operates when discharging both horizontally and vertically.

In connection with the proposed extensions of the Pennsylvania and Long Island Railroads across the North and East Rivers, great interest is taken in the plans suggested for the tunnel under the North River. Experience on the old Hudson River tunnel has demonstrated that the silt in the bed of the North River is about the most treacherous material through which submarine tunneling has ever been attempted. The only way in which a tunnel can be driven through it is by the use of a hydraulic shield and cast-iron lining, together with the use of compressed air; and the silt is so yielding and semi-fluid in consistency that it is quite doubtful whether an ordinary cast-iron-lined tunnel would not be distorted and fractured by the movement of trains.

To meet this difficulty, Mr. Chas. M. Jacobs, the engineer in charge of this work for the associated companies, proposes to stiffen the tunnel by a pair of trusses placed in its interior and to support the ends of these trusses on piers carried down to bed-rock. Application for a patent has been filed by Mr. Jacobs on this novel and unprecedented system of tunnel construction, and at a later date we hope to describe and illustrate it in detail. At present it may be said that the tunnel will be driven with a shield in the usual manner, and then traps will be opened in the bottom at suitable intervals, say 150 feet or more, and cylinder piers will be carried down to bedrock. Later interior trusses will be erected with their ends resting on these piers and firmly secured to the sides of the tunnel. In the completed structure, therefore, the weight and jar of trains will not be carried by the tunnel lining and transmitted to the earth in which it lies as is usually the case. Instead, the trusses will carry the weight of the train and transmit it to the piers.

We need hardly say that the driving of tunnels of the diameter proposed (18 feet 6 inches), and the sinking of the supporting piers to bedrock at a depth exceeding probably the greatest at which compressed air has ever been used, is likely to be an exceedingly difficult piece of engineering work.

COMMUNICATIONS.

Under this heading will be published inquiries addressed to the Editor of COMPRESSED AIR. We wish to encourage our readers in the practice of making inquiries and expressing opinions.

We request that the rules governing such correspondence will be observed, viz.: all communications should be written on one side of the paper only; they should be short and to the point.

One of our correspondents asks for answers to the following questions, and we reply to them in order:

1—What horse power is an engine 10 × 12, 90 revolutions, steam 80 lbs., running at full stroke, no cut-off used 3-inch, supply pipe, boiler 40 feet off?

2—What pounds of coal per horse power hour should run it, 80 horse boiler, well set, in good condition, using Alabama steam coal?

3—What parts of an air compressor require special attention, and when are losses most likely to occur?

4.—Can you give some approximate idea of the amount of loss from an inlet valve that leaks enough to blow a piece of paper from it at say, 12 inches, air pressure, 43 pounds?

1—The calculated horse power of an engine is obtained from a form $\frac{\text{"Plan"}}{33000}$ in which "P" is the mean effective pressure, that is, the average pressure acting on the piston throughout the entire stroke; "L," the length of stroke; "A," the area of piston and square inches; "N," the number of strokes. Using the figures that you give and assuming a pressure of 70 pounds in the cylinder you should get from the engine about 30 H. P.

2—It is impossible to tell exactly how much coal your boiler will consume, but we estimate that it would be from 120 to 200 pounds of coal per hour under the conditions named.

3—An air compressor is very little more than a steam engine with an air cylinder attached, and therefore the attention usually bestowed on engines will be necessary. In addition, the valves of the air cylinders should be kept in good working order so that they will not stick nor leak. The cylinders should be kept clean and free from excessive oil, and oil should not be allowed to accumulate in the ports nor discharge passages connected with the air cylinder. The inlet air should be taken from some place where dust and dirt will not be drawn into the cylinder.

4—If you have any valves about your compressor leaking to the extent mentioned they need immediate attention. We cannot afford you any idea of how much loss would occur from such leaky valves, but we can assure you that it is very considerable. In a general way, a 1-16 inch hole would, with air at 100 pounds, leak over a horse power each five minutes.

U. S. PATENTS GRANTED NOV. 1901

Specially prepared for COMPRESSED AIR.

685,791. AIR FEEDING AND HEATING DEVICE FOR LAMPS. William H. Payne, Camden, N. J. Filed Aug. 15, 1900. Serial No. 26,908.

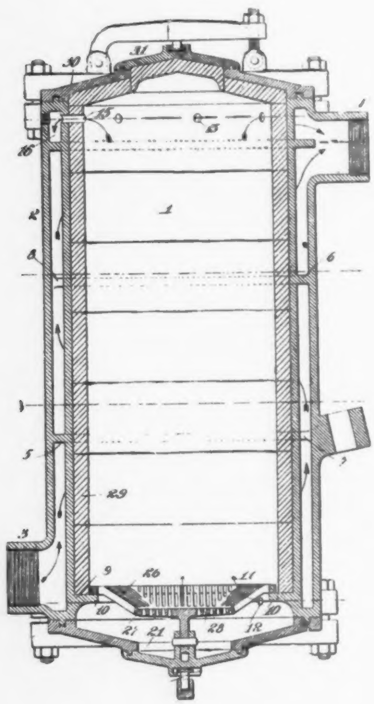
A lamp provided with a depending globe or bowl inclosing the burner and flame and having an opening in its wall below the burner, an air feeding and heating device located wholly within the globe or bowl and comprising a transparent or translucent plate having a perforated downwardly-projecting rim interposed between the burner and the opening in the globe or bowl, and means for supporting the plate and rim above said opening.

685,813. AUTOMATIC AIR-COUPLING FOR RAILWAY-CARS. Oscar L. Brown, Ellisville, Miss. Filed July 25, 1901. Serial No. 69,651.

685,824. TERMINAL FOR PNEUMATIC DESPATCH-TUBE APPARATUS. James T. Cowley, Lowell, Mass., assignor to the Lamson Consolidated Store Service Company, Newark, N. J., a corporation of New Jersey. Filed Aug. 11, 1900. Serial No. 26,584.

An apparatus of the character described, a transmission-tube, a terminal connected to said tube, a suction-tube communicating with said terminal, a pivoted valve in said terminal normally closed and adapted to be opened by the impact of the carriers, a chute connected to said terminal and into which the carriers pass after opening said valve, and stationary means located beyond said valve for guiding the carriers into said chute after they have opened and passed said valve.

685,911. APPARATUS FOR REHEATING COMPRESSED AIR FOR INDUSTRIAL PURPOSES. Thomas A. Edison, Llewellyn Park, N. J. Filed Dec. 6, 1899. Serial No. 739,342.

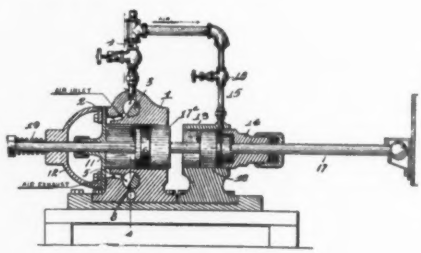


A reheater for compressed air, the combination of a reheating-chamber, a jacket surrounding the same, a grate in said chamber for carrying a combustible material, air-pipes leading directly to and directly from the jacket, an opening connecting the space inclosed by the jacket with the interior of said reheater below the grate, whereby a portion only of the air will be admitted into the interior of the reheater to support combustion of the combustible material, and means for conducting the directly-heated air to the discharge pipe which leads directly from said jacket.

686,061. AIR-PUMP CONNECTION. Samuel E. Hart, Wilmington, Del. Filed Jan. 26, 1901. Serial No. 44,890.

A device of the class described, a barrel having key-ways, a hub surrounding the barrel, having complemental keyways, keys fitted in the respective keyways, a sleeve slidable on the barrel and adapted to engage the hub, and means on the barrel to force the sleeve forward as the barrel is advanced, and means on the hub to prevent the keys from being displaced.

686,087. AIR-MOTOR. John Klein, John N. Shannon, and Frank Foshee, Desloge, Mo., assignors by direct and mesne assignments to said Klein, Paul A. Fusz, Granite, Mont., and Charles D. McLure, St. Louis, Mo. Filed Feb. 25, 1901. Serial No. 48,667.



An air-motor, consisting of a primary cylinder having an inlet-passage to admit air therein and an outlet-passage to permit the exhaust of the air, a rotary valve located in each of said passages for opening and closing the same, a cushion-cylinder having an inlet-passage but no outlet, a single piston-rod operating through both of said cylinders and adapted to be moved in one direction by the admission of air into the primary cylinder and in the opposite direction by the expansion of the air in the cushion-cylinder, and a strong spring adapted to assist in the backward movement of the piston and to move it independently when the cushion-cylinder is not used.

686,115. AIR-COMPRESSOR. Finlay A. McRae and Charles E. Robertson, Montreal, Canada; said Robertson assignor of one-half his right to said McRae. Original application filed Nov. 19, 1897. Serial No. 659,212. Divided and this application filed Feb. 2, 1899. Renewed April 12, 1901. Serial No. 55,572.

A suitable water-head, an inclined water-conductor communicating at its upper end with said water-head, a cylinder, an inlet-opening thereto, the lower end of said conductor being connected to and communicating with said

opening, a series of upwardly-extending deflecting vanes independent of one another, located within said cylinder at said opening, a blower or the like for forcing air into said cylinder, an air-conducting pipe leading from said blower to a point within said conductor and in close proximity to said cylinder, a suitably-mounted shaft located above the surface level of the water-head, a pulley mounted upon said shaft, an endless belt taking over said pulley and extending to within a short distance of the upper end of the conductor, a series of tilting buckets pivotally secured to said belt, a second pulley mounted upon said shaft and an endless belt operatively connecting said second pulley to said blower, a water-discharge opening from said cylinder and an air-outlet from said cylinder.

686,144. PNEUMATIC STRAW-STACKER. James B. Schuman, Columbia City, Ind., assignor to the Indiana Manufacturing Company, Indianapolis, Ind., a corporation of West Virginia. Filed June 15, 1901. Serial No. 64,727.

686,145. PNEUMATIC STRAW-STACKER. James B. Schuman, Columbia City, Ind., assignor to the Indiana Manufacturing Company, Indianapolis, Ind., a corporation of West Virginia. Filed June 15, 1901. Serial No. 64,728.

686,257. DRILL ATTACHMENT. John Burgh, Reynoldsville, Pa. Filed May 13, 1901. Serial No. 60,073.

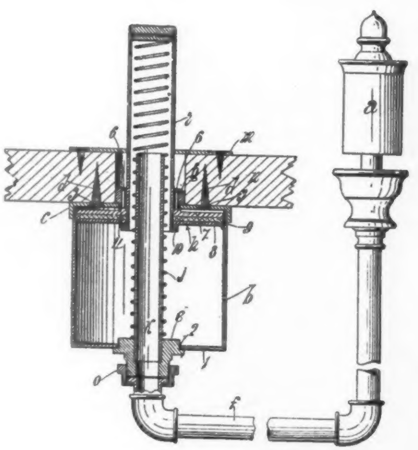
A pneumatic hand-drill having a guide parallel with and on one side of the plunger and a spring-projecting staff, carried by said guide and adapted to engage the work.

686,418. GAS AND AIR MIXER. Buford Murray, Fairfield, Iowa, assignor of two-thirds to Louis O. Gaines and Frank D. Gaines, Fairfield, Iowa. Filed May 8, 1901. Serial No. 59,340.

686,427. APPARATUS FOR COMPRESSING GASES. William T. Sugg, Westminster, England. Filed July 23, 1901. Serial No. 69,383.

An apparatus for compressing gases, the combination with a single base-plate having within it both ports and passages for a motor fluid and ports and passages for the gas to be compressed, of horizontally-oscillating motor-cylinders and horizontally-oscillating compressing-cylinders, a crank-shaft arranged perpendicularly to said base-plate and in relation to which the said motor-cylinders and compressing cylinders are radially arranged, and connections between the said crank-shaft and the piston-rods of said motor-cylinders and compressing-cylinders.

686,438. AIR-COMPRESSOR FOR AUTOMOBILE ALARM WHISTLES. Calvin C. Bowen, Morrisson J. Barnett and Frank Newnham, Los Angeles, Cal., assignors to the Rindge Manufacturing Company, Los Angeles, Cal., a corporation of California. Filed Aug. 24, 1900. Serial No. 27,906.



The combination of a cylinder; a pipe leading from the cylinder; a piston in the cylinder; a tubular stem fastened to the piston and projecting from the cylinder and closed at its outer end; a spiral spring extending inside the tubular stem to retract the piston; an open-end tube communicating with the pipe and fastened to the head of the cylinder and extending inward therefrom inside the spiral spring and into the tubular stem to form a guide for the spring to prevent it from buckling.

The combination of a cylinder open at one end and furnished at the other end with a head having a screw-threaded perforation; a screw-cap adapted for attachment to a support and screwed to the open end of the cylinder and having a like screw-threaded perforation; a bushing to fit the perforations interchangeably screwed into one of the said perforations; a pipe fastened to said bushing and communicat-

ing therethrough with the cylinder; a bushing to fit the perforations interchangeably screwed into the other of said perforations; a piston in the cylinder; a stem fastened to the piston and projecting through the second bushing; and means for retracting the piston.

686,444. ROCK-DRILL. Henry D. Crippen, New York, N. Y., and George White and George S. Maxwell, Jersey City, N. J., said White and Maxwell assignors to said Crippen. Filed Dec. 31, 1900. Serial No. 41,551.

A percussive rock-drill, the combination of a suitable support provided with ways, an electric motor on the support, percussive drilling mechanism fitted on the ways, a percussion spring, intermediate variable connections between the armature of the motor and the drilling mechanism, to retract the drill against the force of the spring, said drilling mechanism and intermediate connections being arranged outside of the motor, and means feeding the drilling mechanism independently of the motor, while the motor maintains a constant position on the support.

686,530. APPARATUS FOR THE LIQUEFACTION OF ATMOSPHERIC AIR. Oscar P. Ostergren, Bedford Park, N. Y., assignor to Ostergren Manufacturing Company, a corporation of New Jersey. Filed June 19, 1900. Renewed April 17, 1901. Serial No. 56,219.

A combination of means for compressing air and separating the moisture deposited by compressing and cooling it, consisting of the air compressor and cooler and its moisture-trap, counter-current equalizer and its series of traps, and the expanding, cooling and power generating engine and liquid-air separator having the counter-current plunger-piston, said compressor and cooler, equalizer and engine suitably connected for circulation of the compressed air through them respectively and for return of the waste expanded air from the engine through the equalizer.

686,531. REFRIGERATING AND VENTILATING APPARATUS. Oscar P. Ostergren, Bedford Park, N. Y., assignor to the Ostergren Manufacturing Company, a corporation of New Jersey. Filed June 11, 1900. Renewed April 17, 1901. Serial No. 56,220.

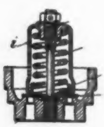
The combination with a chamber or room to be cooled by an evaporating liquid, of the container for the liquid having a labyrinthal insulating jacket, an outlet from the upper inner space for the vapors into said jacket, a discharge-passage from the exterior of the jacket for the vapors, valves controlling the escape of the vapors into the chamber, or outward therefrom, according as the temperature of the room varies, and a thermostatic controller for said valves, said controller subject to the varying temperature of the room for controlling it.

686,680. PNEUMATIC DESPATCH TUBE CARRIER. Albert W. Pearsall, Mount Vernon, N. Y., assignor to the Pearsall Pneumatic Tube and Power Co., New York, N. Y., a corporation of New York. Filed April 3, 1901. Serial No. 54,207.

A carrier or receptacle open at one end, a swinging strap at said open end, and an eccentrically-pivoted cover on the strap made to engage the carrier, said cover having studs riveted or secured flush to the cover to clear or glide over and be independent of the strap, one of the studs being centrally located so as to be adapted for bolting or securing a felt or packing, and the other stud or studs being located eccentrically to prevent rotation of the packing relatively to the cover.

686,682. PNEUMATIC KEY-STRIKER FOR MECHANICAL MUSICAL INSTRUMENTS. Harry M. Salyer, New York, N. Y., assignor to the firm of Ludwig and Company, Borough of Bronx, New York, N. Y. Filed July 7, 1900. Serial No. 22,775.

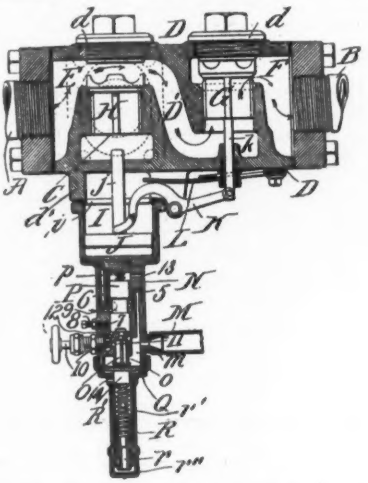
686,736. PRESSURE VALVE FOR COMPRESSORS. Emil Josse, Wilmersdorf, Germany. Filed Nov. 26, 1900. Serial No. 37,774.



The combination of an annular valve-seat, a valve proper co-operating therewith, said valve proper comprising a plate having a collar thereon and a spring engaging said collar to guide the valve proper in its movement and to normally maintain the valve on its seat.

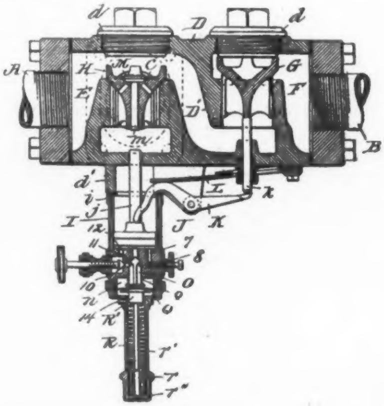
686,778. RELIEF GOVERNOR FOR AIR COMPRESSORS. Geo. F. Steedman, St. Louis, Mo. Filed Sept. 30, 1899. Serial No. 732,198.

The combination with a suitable casing formed with chambers E and F, of a check-valve for opening communication between said chambers, a valve for controlling communica-



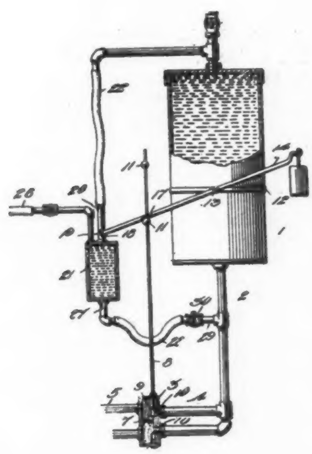
tion between chamber E and the open air, a piston for actuating said last-mentioned valve, a lever, means acting on said lever tending to raise the check-valve between said chambers when the valve in chamber E is closed, and automatically actuated valves for admitting and exhausting pressure to and from behind said piston.

686,779. RELIEF GOVERNOR FOR AIR-COMPRESSORS. Geo. F. Steedman, St. Louis, Mo. Filed March 25, 1901. Serial No. 52,840½.



The combination with a compressor and its delivery pipe having a vent to atmosphere, of valves of different area exposed to pressure, which valves are normally held seated by fluid-pressure to close such vent, and fluid-pressure mechanism for successively actuating said valves, said mechanism first raising the valve having the smaller area to relieve pressure above the valve having the larger area, to open the vent and establish communication therebetween and the compressor when the pressure delivered by the compressor has reached or exceeded the maximum.

686,784. AIR-COMPRESSOR. James P. Tryner, Pueblo, Colo. Filed May 7, 1900. Serial No. 15,764.



An air-compressor, comprising a cylinder having a valved air-inlet and an air-outlet, water-pipes for said cylinder to fill the same with water and to drain the water from the cylinder, valves for controlling the inflow and discharge of the water to and from the cylinder, a controlling device for said water inflow and discharge valves, said controlling device being controlled by the overflow of the water from said cylinder, and said controlling device comprising a lever for controlling said valves, to alternately open and close them, a receptacle on said lever, a connection between the upper end of said cylinder and said receptacle, to conduct the overflow water from the cylinder into said receptacle to overbalance the lever and to cause the same to swing and change the positions of

said valves, a tube leading from the receptacle and connected with the cylinder, and a valve therein adapted to release water from the receptacle after the cylinder has been emptied.

686,798. AIR-BRAKE COUPLING. George H. Balentine, Laurens, S. C. Filed Aug. 21, 1901. Serial No. 72,730.

686,834. PNEUMATIC HUB FOR CYCLE OR OTHER WHEELS. Hans P. Rasmussen and William Hagerty, Winton, Southland, New Zealand. Filed June 7, 1901. Serial No. 63,644.

686,844. AIR-MOTOR. Charles L. Davis, Chicago, Ill., assignor, by mesne assignments, of one-half to August Heuer, Jr., Charles A. Brown, George L. Cragg, and A. Miller Belfield, Chicago, Ill. Filed Jan. 26, 1900. Serial No. 2,928.

The combination with the bellows having ports leading thereto; of reciprocating valve-spindles, each attached to a flexible diaphragm in a vacuum-chamber, and each provided with valves controlling the ports leading to the bellows; an air-port communicating with the space between said diaphragms; a valve controlling the admission of air to said port; and means for operating said valve from the operation of the bellows, so as to produce a continuous reciprocation of the latter.

686,976. AIR-RETAINING VALVE. Richard W. Kelly and Henry T. Hazard, Los Angeles, Cal. Filed Nov. 15, 1899. Serial No. 737,126.

686,986. PNEUMATIC STRAW-STACKER. Frederick L. Norton, Racine, Wis. Filed May 6, 1901. Serial No. 59,026.

687,040. AIR-FEEDING DEVICE FOR FURNACES. Charles R. Littler, Selkirk, Canada. Filed March 21, 1901. Serial No. 52,165.

687,169. APPARATUS FOR COMPRESSING GAS, AIR, ETC. Chas. Scott-Snell, Saltash, England, assignor, by mesne assignments, to the Scott-Snell Self-Intensifying Gas Lamp Company, Limited, London, England. Filed Feb. 5, 1900. Serial No. 4,070.

An apparatus for compressing elastic fluid by the agency of heat, consisting of a direct-acting hot-elastic-fluid pump without fly-wheel, comprising in combination; a displacer moving in a chamber, one part of which is heated and another cooled; spring-controlled means for operating said displacer by the rise and fall of pressure of said elastic fluid, said means coupling directly to the displacer without rotating parts; inlet-valve admitting elastic fluid to the chamber, and outlet-valve permitting discharge of elastic fluid from said chamber.

687,181. HOT-AIR BATH. Frederick C. Dilthey, Rockville Center, N. Y., assignor of one-half to Joseph H. Deskau, New York, Borough of Brooklyn, New York. Filed Aug. 2, 1900. Serial No. 25,648.

687,201. PNEUMATIC DESPATCH TUBE APPARATUS. James T. Cowley, Boston, Mass. Filed March 15, 1901. Serial No. 51,402.

687,202. PNEUMATIC DESPATCH TUBE APPARATUS. James T. Cowley, Boston, Mass., assignor to Lamson Consolidated Store Service Company, Newark, N. J., a corporation of New Jersey. Filed July 10, 1901. Serial No. 67,754.

A pneumatic despatch tube apparatus, a valve closed at its outer end to the atmosphere and open at its inner end to the tube for regulating the pressure in the despatch tube, a screw-threaded shaft, and a stationary nut with which said screw-threaded shaft is adapted to operate for sliding the valve inwardly and outwardly for closing and opening the same.

687,266. PNEUMATIC SEPARATOR. Albert Raymond, Chicago, Ill. Filed Oct. 9, 1899. Serial No. 733,004.

687,270. INDICATING DEVICE FOR PNEUMATIC-TUBE CARRIERS. William A. Rodliff, Lowell, Mass., assignor to Lamson Consolidated Store Service Company, Newark, N. J., a corporation of New Jersey. Filed July 10, 1901. Serial No. 67,766.

687,297. ELECTRIC RELEASING APPARATUS FOR PNEUMATIC PRESSURE BRAKES. August Bruggemann, Breslau, Germany, assignor to the Deutsche Waffen-Und Munitionsfabriken, Carlsruhe in Baden, Germany. Filed Aug. 2, 1900. Serial No. 25,670.

687,646. AIR BRAKE FOR WAGONS. David Nickel and Jacob G. Boyer, So. Bethlehem, Pa. Filed June 5, 1901. Serial No. 63,302.

687,668. AIR AND GAS MIXER FOR BURNERS. William G. Taylor, Pittsburg, Pa., assignor to Taylor Burner and Electro Plating Company, Limited, Pittsburg, Pa. Filed April 23, 1900. Serial No. 13,890.